Appendix A

In the following it is shown that the envelope of the following signal is periodic with a period of either multiple or submultiple of P_0, i.e. the inverse of the fundamental frequency f_0.

$$y(t) = a_m \cos(m\omega_0 t + \phi_m) + a_n \cos(n\omega_0 t + \phi_n) \tag{A1}$$

Rewriting equation (A1) yields

$$y(t) = a_m \cos(m\omega_0 t + \phi_m) + a_m \cos(n\omega_0 t + \phi_n) + (a_n - a_m)\cos(n\omega_0 t + \phi_n) \tag{A2}$$

$$y(t) = 2a_m \cos\left(\frac{(m-n)\omega_0 t + \phi_m - \phi_n}{2}\right) \times \cos\left(\frac{(m+n)\omega_0 t + \phi_m + \phi_n}{2}\right) + (a_n - a_m)\cos(n\omega_0 t + \phi_n) \tag{A3}$$

If $(m+n)$ is much greater than $(m-n)$, the first term in the above equation (A3) implies amplitude modulation. The lowpass signal is then expressed as

$$\xi(t) = a\cos\left(\frac{(m-n)\omega_0 t + \phi_m - \phi_n}{2}\right) \tag{A4}$$

The period of the envelope $\xi(t)$ is $\frac{2P_0}{(m-n)}$ which is a (sub)multiple of P_0. The second term in equation (A3) has no effect on the envelope due to being filtered out by the demodulator.